AGRICULTURAL Research

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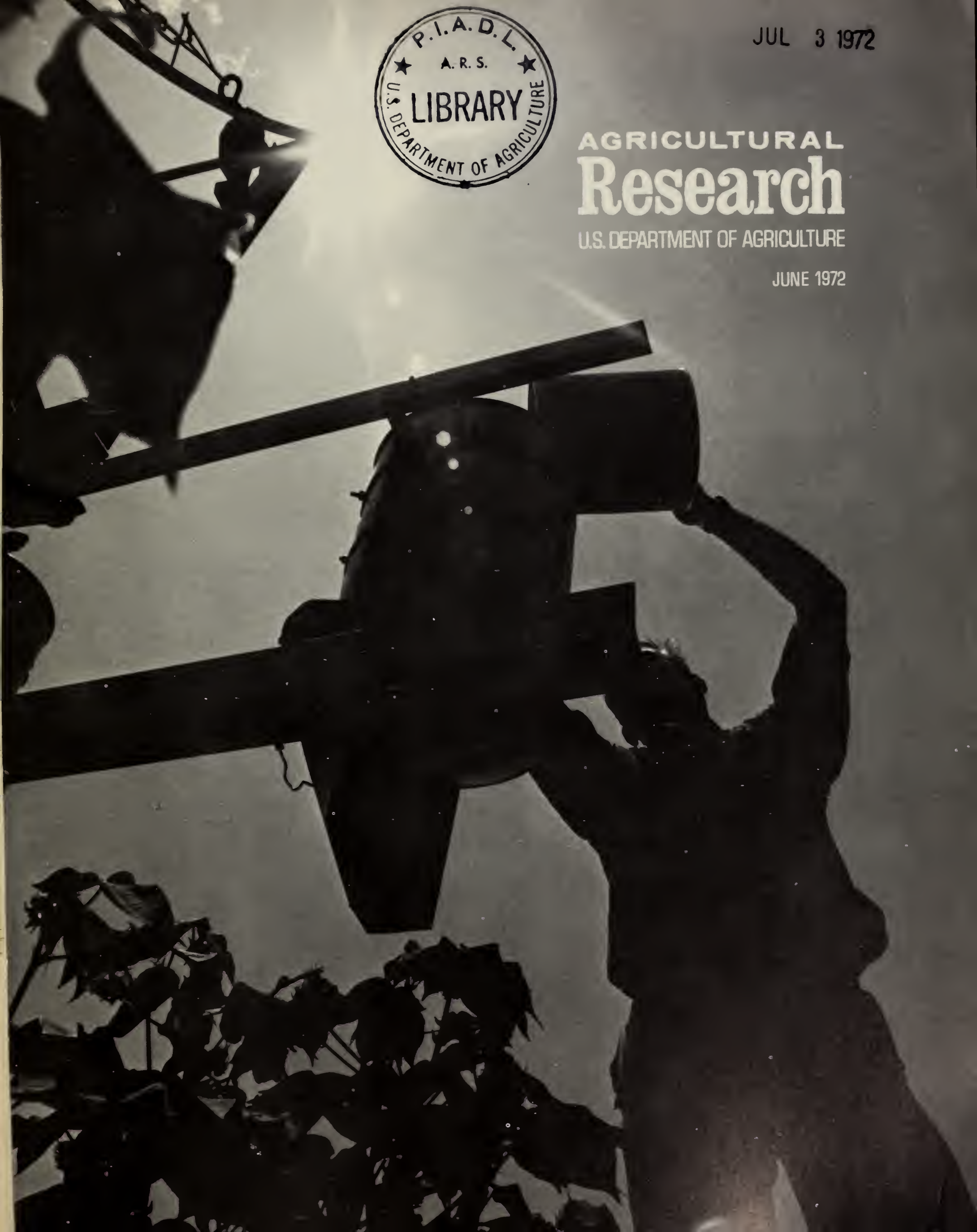

AGRICULTURAL
Research

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Plant Geometry

A "new look" is emerging in the architecture of plants, one ordained not by nature but by man. For lines, curves, and angles, while intrinsic to plantlife, are assuming greater importance as agricultural science redesigns and reshapes plants to meet changing needs.

An overview of this trend can be observed in commercial tomato fields, the bulk of which are harvested mechanically because of labor shortages. There today's tomato varieties, compared with yesterday's, feature more compact vines, fewer leaves, and oblong fruits. Although compact, the vines develop many lateral but few single stems, thereby presenting a wide swath to the rumbling machines which straddle the rows and in one pass make short work of harvesting a crop of tomatoes bred to ripen together. Fewer but more efficient leaves, on the other hand, foster a drier micro-climate around tomato clusters, one less hospitable to moisture-loving disease organisms. And the tough-skinned oblong fruits have been designed to withstand the bruising and other rigors of machine harvesting and bulk handling.

Another genetically-induced structural change involves the bounteous wheats and rices of Green Revolution fame. Breeders designed these crop plants to have shorter and stiffer straws—traits that permit heavy rates of fertilizer use without loss to lodging. The strengthened straw, along with a package of practices that includes genes for high yields, fertilizer, and management have increased wheat crops in areas of adaptation in India and Mexico by five and six fold.

The shear and saw, not genetics, are the main tools for redesigning tomorrow's orchard trees. With mechanical harvesting of apples still in its infancy, varied efforts are underway to mold the tree to the machine. Trees are being pruned to grapevine-like forms about six feet high and only three feet wide when in full foliage to enable a harvesting machine to travel over the row; other trees are being pruned with slot-like openings to receive the machine with its shaker and fruit-catching canopy.

Even as man strives to build a new order, he sometimes returns to the old. In pruning today's landscape shrubs, for example, the trend is to a sculptured form that is natural with open and flowing lines, a marked contrast with recently favored dense and mushroom-like forms. The future holds many unknown changes and needs. But working as a partner of nature, aware of her laws, man can train plants to work for him while still preserving their diversity and essence.

Editor: *R. P. Kaniuka*
Managing editor: *E. H. Davis*

Contributors to this issue:
R. C. Bjork, V. R. Bourdette, J. P. Dean, V. M. Dryden, C. E. Herron, M. E. Nicholas, M. J. Phillips, N. E. Roberts, M. F. Tennant, D. M. Webb, L. C. Yarris

COVER: In tests to biologically control pests with their natural enemies, entomologist Richard E. Kinzer fills hopper of dispenser with lacewing larvae and sawdust mixture for distribution over cotton foliage. See page 8 (771K924–8).

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Earl L. Butz, Secretary
U.S. Department of Agriculture

Talcott W. Edminster, Administrator
Agricultural Research Service

LOOKING CLOSER at DIET & EXERCISE

CAN a moderate exercise program affect individual body weight regardless of the type of carbohydrate consumed in the diet?

Nutritionists are giving increased attention to this and other diet-exercise questions by identifying some of the dietary factors involved in the metabolic response to exercise. One ARS-sponsored study indicates that recommendations regarding both the kind and amount of carbohydrate should take into account the level of the individual's physical activity.

In two 8-week experiments a team of University of Maryland scientists, headed by Maryland nutritionist Richard Ahrens and ARS research nutritionist Carolyn Berdanier, studied the effects of age and type of dietary carbohydrate on the responses of laboratory animals to moderate forced exercise.

Weanling and mature male rats were fed a nutritionally adequate, moderately high-fat diet which contained either cornstarch or a mixture of starch and sugars approximating the proportion found in a U.S. "market basket diet." The carbohydrate portion of the diets constituted 12 percent of the animals' calorie intake.

Each of the two studies—one using weanling rats and the other 150-day-old mature rats—involved 90 males of the Wistar breed, 10 of which served as controls. The remaining 80 were divided into two groups of 40 each. In

the case of the weanling rats, one of these groups was allowed to eat as much as it wanted and the other given weighed amounts of food to insure that the exercised and sedentary animals had similar food intakes. None of the mature rats was limited as to the amount of food consumed.

Within each of the 40-rat groups, 20 were fed the diet containing cornstarch and the other 20 the diet containing the starch-sugar mixture. Half of the rats on each diet were forced to run one-fourth mile in 30 minutes on a treadmill each day while the other half spent the same 30 minutes in a nonmobile treadmill compartment.

The mature animals lost body weight with exercise but the young animals continued to gain weight as a result of growth. Exercised rats of both ages gained less or lost more carcass fat than their sedentary opposite numbers receiving the same carbohydrate.

Under sedentary conditions the animals that consumed the cornstarch accumulated more body weight and carcass fat than the animals fed the carbohydrate mixture. When the rats were forced to exercise, the effect was reversed. This was true for both age groups, indicating that responses of both young and mature rats to forced exercise were modified similarly by the type of carbohydrate and that age was not an important factor.

Research diets often include cornstarch as the carbohydrate. When a mixture more in line with the U.S. diet is substituted for the cornstarch, the effectiveness of exercise in fat and weight control is reduced.

Results of the two-part study indicate that moderate exercise lowers food intake, body weight gain, carcass fat gain, serum cholesterol, and serum insulin. They also show that the exercised and sedentary animals of both ages differed in their response to the carbohydrate in the diet and that the suppression of body weight, insulin, and cholesterol levels due to exercise was modified by the carbohydrate source in both the young and the mature animals.

Dr. Berdanier (left) and Dr. Ahrens discuss results which show that older rats adapt to exercise in much the same way as young ones do (372A273–13).

The study also indicates a need to investigate the sequence of events that occurs in animals during and after exercise to discover possible interactions between the effects of various hormones as well as between the diet and exercise.

"It is possible," Dr. Ahrens explained, "that there are hormone-hormone, diet-hormone, and exercise-hormone interactions as well as dietary carbohydrate-exercise interactions. If the time course of changes in the level of circulating hormones and glucose is known, it might explain why the effect of dietary carbohydrate on weight gain and composition is different for exercised and sedentary animals." □

AIR CONDITIONING CUTS GIN POLLUTION

CONDITIONING THE AIR that transports cotton through the gin could mean another $100 million annual income for cotton farmers and do a lot toward reducing air pollution.

The additional profits come from increasing the staple length of lint cotton by one-sixteenth of an inch through better moisture control. This increase in length means higher use value.

Lint quality was the first concern of the ARS agricultural engineers who developed the "monoflow" system. Current concern for the environment led them a step farther, and better pollution control was the result.

Seed cotton and lint cotton are transported from one machine to another through a gin by an air transport system. Conventionally, a device like a giant vacuum cleaner picks up cotton from field wagons to the first machine. The air, which is consequently taken from the atmosphere, is then exhausted to the outside. Each succeeding movement of cotton from one machine to the next means taking air in and exhausting it to the outside. In modern gins this results in usually five separate intakes and five separate exhausts. It would be nearly impossible, or at least too expensive, to condition each separate air intake.

The monoflow system, the brainchild of ARS physicist Clarence G. Leonard and agricultural engineer Marvis N. Gillum, Mesilla Park, N. Mex., conveys cotton with one air intake, recycling after cleaning, filtering, and conditioning the air as it makes its way to the final exhaust. Only a small amount of air is voided to the outside. All other necessary exhausts in the system are clean enough to void into the gin room.

Because the system is designed to capture almost all of the particulate matter, it should greatly reduce air pollution and should not influence gin capacity.

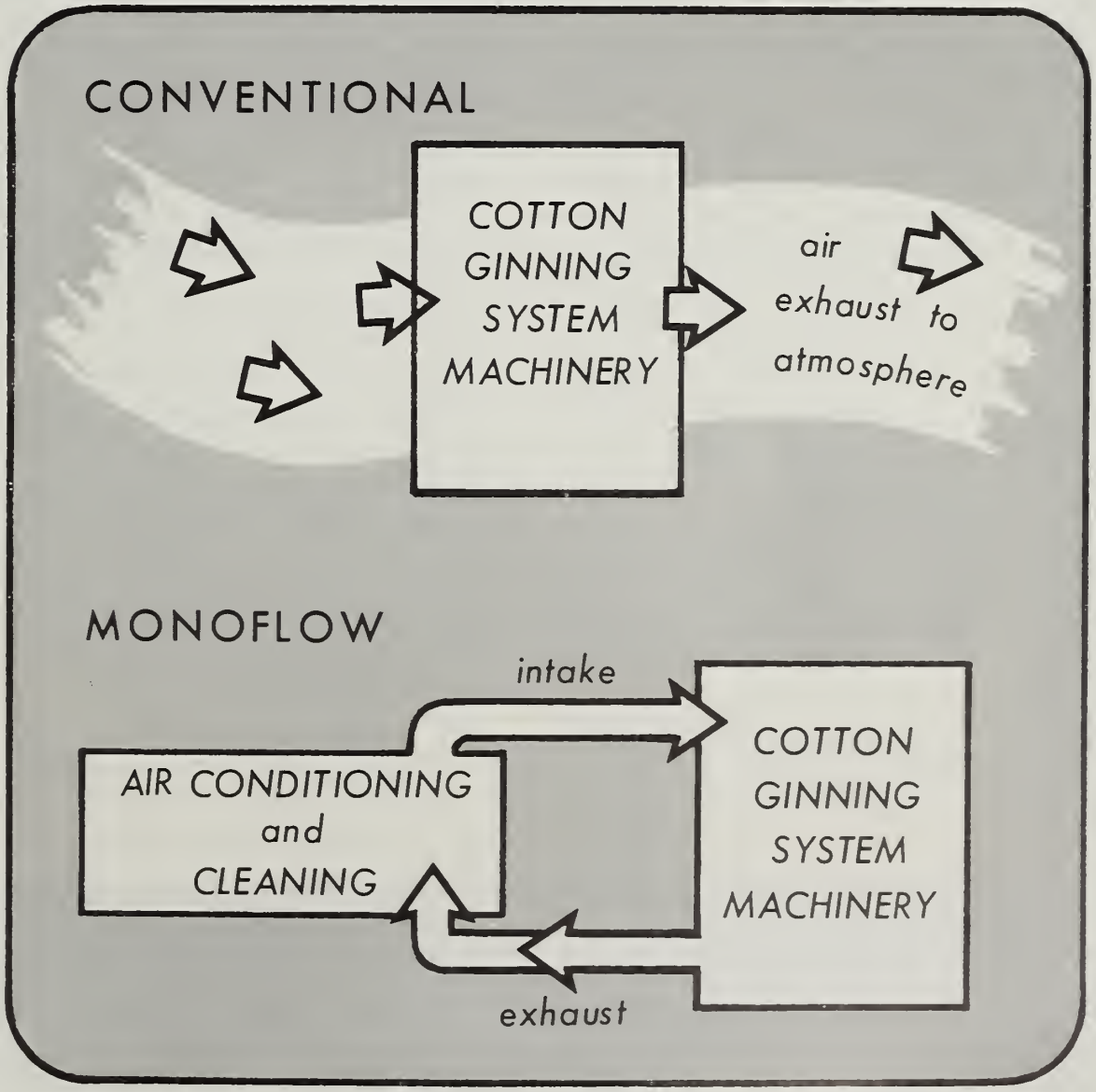
Key components in the system for controlling the moisture content of the air are two air conditioners. They can heat the air if the cotton is to be dried, or humidify it if moisture is to be added or restored. Raw cotton will not readily absorb water. Therefore, it is imperative that the moisture be exposed to the cotton in vapor form.

The basis of moisture control in the monoflow system is the hygroscopic property of cotton; that is, its ability to "respond" or come to a moisture equilibrium that depends upon the relative humidity of the surrounding air.

In the conventional system of ginning, that hygroscopic property works to the ginner's disadvantage, since most of the time the cotton is going into and out of unconditioned air streams over which there is no moisture control. The monoflow system, taking advantage of the hygroscopic properties, controls cotton moisture all the way through the gin by controlling humidity of the air.

One problem with the system is that it costs about 10 percent more to build than conventional systems—air conditioners, custom-made ductwork, and other features. This means about $30,000 to $40,000 extra.

In view of the number of States passing stringent regulations on air quality emissions, however, the development may be timely in helping ginners meet air quality standards. □



NO HERBICIDE RESIDUES IN MEAT

Normal use of chemical weed and brush killers on rangelands appears to offer no problem of harmful residues in the meat of animals that graze these ranges.

Silvex, 2,4-D, and 2,4,5-T are chlorophenoxy herbicides registered for use in controlling broadleaf and woody plants—including mesquite on rangelands where sheep and cattle graze. Ranchers have been concerned that ingestion of herbicides from treated ranges could result in contamination of the meat, making it unfit for human consumption. However, ARS scientists have found that residue levels in the meat readily disappear.

Led by ARS chemist Donald E. Clark, College Station, Tex., a team of scientists conducted experiments in feeding silvex, 2,4-D, and 2,4,5-T to sheep and cattle.

The experimental animals, 32 cattle and 24 sheep, were fed 3 percent of their body weight in rations containing the various levels of the herbicides daily. The feeding program continued for 28 days.

Cattle were fed either silvex or 2,4-D at three levels—2,000, 1,000 and 300 parts per million (ppm). Feeding 300 ppm of these herbicides represents the normal level of feed contamination that could be expected after application of the pesticides to rangeland. However, this concentration would last for only a few days under natural conditions and not as long as the 28 days in the experiment. The 2,000 and 1,000 ppm rates simulate levels resulting from gross negligence in applying the herbicides.

The scientists divided the sheep into four groups of six animals and fed them 2,000 ppm of either silvex, 2,4-D, or 2,4,5-T or kept them as controls.

Both cattle and sheep fed 2,000 ppm of herbicide were slaughtered in two groups—one 24 hours after the last feeding of the pesticide, and one 7 days later. Scientists analyzed tissues from all the animals independently for pesticide levels in ARS laboratories, a herbicide manufacturing company, and USDA's Agricultural Marketing Service.

They found significantly reduced herbicide levels of all three compounds after the 7-day withdrawal period. For example, cattle fed 2,000 ppm of the silvex and slaughtered within 24 hours had residues of 1.0 ppm in the muscle, 3.8 ppm in the fat, 8.4 ppm in the liver, and 24.0 ppm in the kidney. By contrast, cattle fed at this level and slaughtered 7 days later had residues measuring 0.11 ppm in the muscle, 0.67 ppm in the fat, 0.55 ppm in the liver, and 1.13 ppm in the kidney.

When the cattle were fed 300 ppm silvex and slaughtered within 24 hours, residues of 0.07 ppm in the muscle, 0.66 ppm in the fat, 5.73 ppm in the liver, and 22.40 ppm in the kidney were found.

Both cattle and sheep fed 2,4-D at the 2,000 ppm level had less than 1 ppm in all tissues, except for the kidneys, when slaughtered within 24 hours. With 2,4-D at the 300 ppm level, residues in cattle slaughtered after 7 days could not be detected in the muscle or liver and only 0.13 ppm was detected in the fat and 2.62 ppm in the kidney.

Sheep fed 2,4,5-T and slaughtered after 7 days showed only trace amounts of residue in the tissues.

Muscle, which makes up the bulk of the animal used for food, had the least residues for all compounds and at all treatment levels.

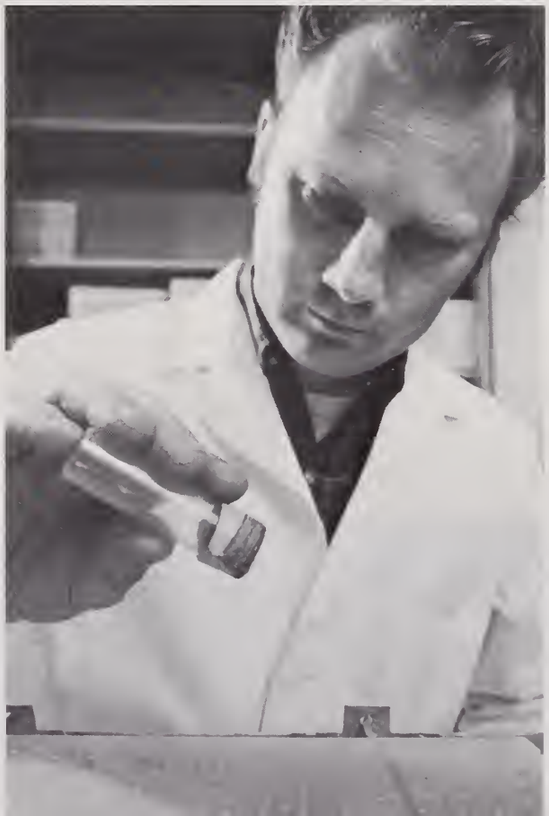
Scientists point out that, before slaughter, most livestock are sent from the range to feedlots for an average finishing period of over 100 days. Even on ranches, there usually is a finishing period during which livestock are not exposed to the pesticides. □

	Residue levels (ppm) after 24 hours				Residue levels (ppm) after 7 days			
	Muscle	Liver	Fat	Kidney	Muscle	Liver	Fat	Kidney
CATTLE:								
Silvex:								
2,000 ppm	1.00	8.37	3.77	24.27	.11	.55	.67	1.13
300 ppm	.07	5.73	.66	22.40	.....	.....	.....	.....
2,4-D:								
2,000 ppm	.07	.22	.24	10.93	.04	.22	.28	.31
300 ppm	(*)	(*)	.13	2.62	.....	.....	.....	.....
SHEEP:								
Silvex, 2,000 ppm	1.40	6.23	.74	9.33	.01	.14	.04	.13
2,4,5-T, 2,000 ppm	1.00	2.29	.25	27.23	(*)	(*)	<.05	<.05
2,4-D, 2,000 ppm	.06	.98	.10	9.17	(*)	.27	.15	.37

*No detectible residue.

***Below:** Entomologist Richard E. Kinzer measures out* Chrysopa*-sawdust mixture into container for field releases (771K928–11).*

***Below left:** Adult* Chrysopa. *In preliminary tests, adults released in the field produced fewer predatory offspring than adults reared in the laboratory (771K927–20).* ***Below right:** Technician V. Sam House sprinkles* Chrysopa *eggs onto rearing frame. Lab rearing results in much higher survival rate than occurs in nature (771K930–30).*



LACEWING

IN A BATTLE staged in Texas cotton fields between lacewing larvae and the injurious bollworm and tobacco budworm, the lacewing has been victorious every year for the past 5 years. These victories have increased cotton yields an average of twofold.

Such results are particularly encouraging because the difficulty of obtaining consistent results over an extended period has been one limitation of some biological control methods.

ARS entomologists Richard E. Kinzer and Richard L. Ridgway and technician S. Larry Jones are conducting this large-scale study at College Station. They attribute their success to better knowledge of the predator, the pests, and their common environment, and to development of ways to rear large numbers of lacewings in the laboratory. With the new techniques,

Below: *Agricultural engineer B. G. Reeves spreads* Chrysopa*-sawdust mixture from specially-designed dispenser at a rate of about 2 to 5 gallons per acre and predators in the mixture at a rate of about 100,000 per acre (771K924–12).* ***Right:*** *Technician S. Larry Jones collects insects with vacuum machine, a familiar tool used to find out how much natural predation occurs, which indicates number of lab predators needed, and how many predators remain after a given period. (771K922–35).*

LARVAE: Victor of the Cottonfield

scientists released some 2 million lacewing larvae on about 10 acres in 1971.

The green lacewing, *Chrysopa carnea,* is a naturally occurring insect predator which is harmless to man and livestock. Because this species is one of the most abundant kinds of lacewing, ARS entomologists selected it for the tests rather than about five other kinds commonly found in Texas.

Behavior studies with the green lacewing indicate why it is so effective: During the day, lacewing larvae aggressively search among the bracts of cotton squares (buds) where bollworms and tobacco budworms normally occur and attack and devour the pests.

For field tests in 1971, ARS entomologist Richard K. Morrison produced over 300,000 lacewing eggs per day. He employed a unique way to rear the laboratory colonies by providing adults with a high-protein artificial diet applied as a paste to kraft paper strips on which females deposit their eggs. Newly hatched lacewings are fed either eggs of the Angoumois grain moth, which is also reared in large numbers in the laboratory, or artificial insect eggs (AGR. RES., May 1971, p. 3).

In coordination with Mr. Morrison's laboratory studies, Mr. Kinzer worked on field applications, developing a method to rear and release 1- to 3-day-old lacewing larvae in a mixture of sawdust and food. The sawdust minimized cannibalism and provided uniform distribution of insects in the field.

Agricultural engineer Beverly G. Reeves of the Texas Agricultural Extension Service, College Station, devised a back-pack dispenser for the sawdust mixture for use on a small scale. He also designed and built—using mostly commercially available components—a 4-row dispenser for larger scale tests. The dispenser utilizes a fluted feeder that minimizes mechanical injury to the lacewing larvae when they are spread over cotton foliage. An electric vibrator plate was also added to prevent clogging and other irregularities that might prevent uniform flow of the sawdust.

Results of the 1971 tests, plus those made on a smaller scale in earlier years, indicate that green lacewing larvae can effectively control bollworms and tobacco budworms on cotton. However, costs of such a program cannot be accurately estimated until a large rearing facility can be tested and operational experiments are conducted on at least several hundred acres.

The Texas Agricultural Experiment Station and Cotton Incorporated are cooperating in the ARS experiments. □

Engineers pulverize shredded hide collagen in one of the preparatory steps for making gels (1170A1063–10).

COLLAGEN YIELDS NEW FOOD & FEED ADDITIVES

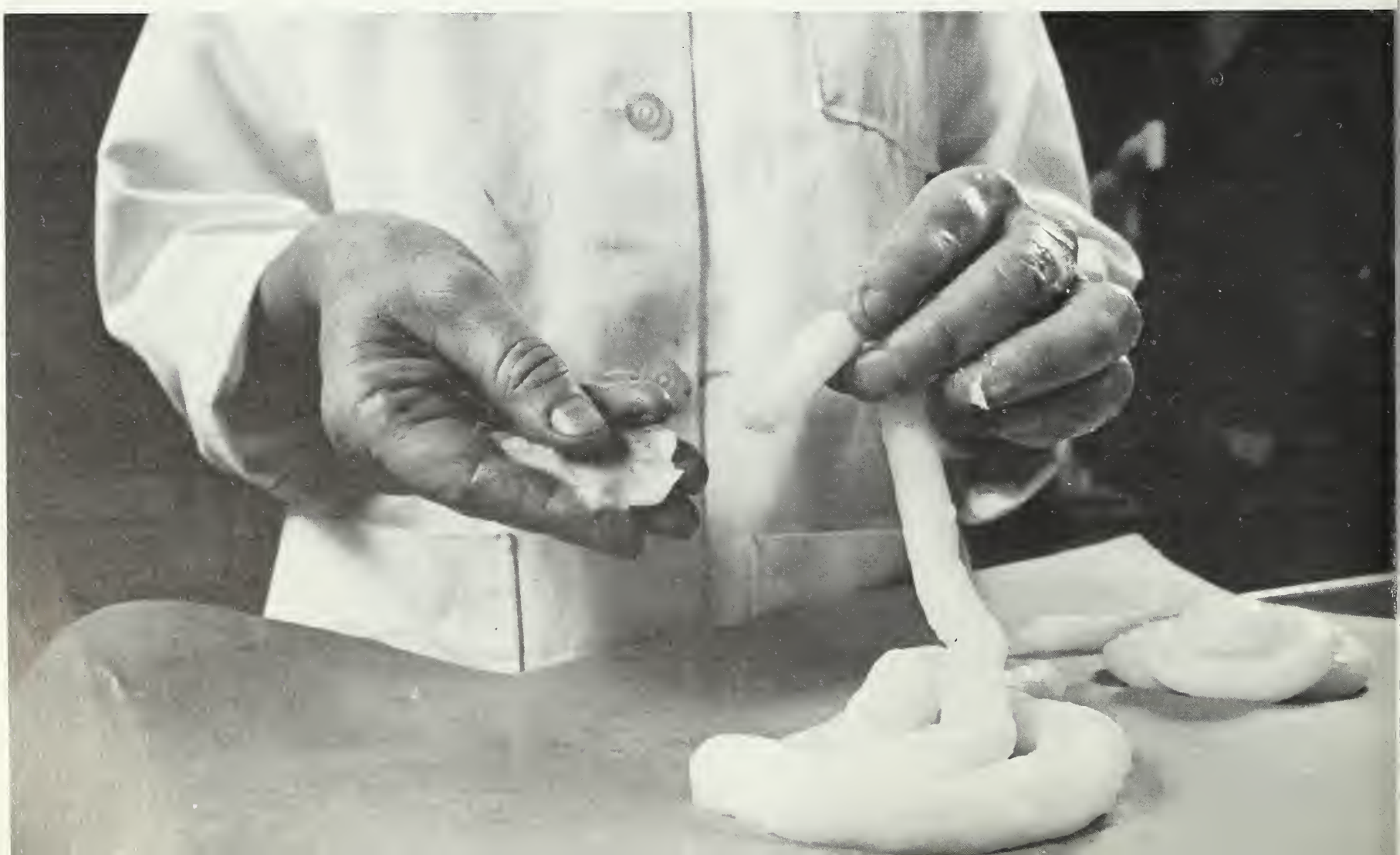
One of the experimental gels after extrusion through a homogenizer (1170A1055–4).

GELS twice as strong as ordinary gelatin and insoluble in boiling water can be made by a novel method of processing animal hide collagen.

The method consists of dispersing finely chopped collagen into acid, neutral, and alkaline solutions and allowing them to stand. Conventional hide gelatin, or glue, is simply a hotwater extraction of gelatin liquors from the hide.

The new gels might be added to flours and meals as a lubricant, or used in catfish or shrimp feed. They may have food applications as well.

Chemist Robert A. Whitmore and his colleagues at the ARS Eastern marketing and nutrition laboratory, Philadelphia, Pa., developed the gels after years of experimentation with collagen. The principal constituent of hide collagen is a wholesome protein with physical characteristics suggesting many food



and feed uses. It is already used commercially for sausage casings. If more trimmings and parts of hide that do not make quality leather were diverted to other collagen products, the overall value of hides and skins might be increased to the benefit of packers and tanners as well as consumers.

The dispersions are made from cattlehide splits (the flesh side of hides remaining after removal of the grain layer to make shoe leather). The splits are chopped into tiny pieces and suspended in acid and alkaline solutions of various pH levels to make 6-percent collagen dispersions. Homogenizing the fluids reduces the collagen to fibrils.

At alkaline ratings of pH 10.5 and above, swelling of the collagen fibrils gives the dispersions a substantial viscosity. At acid ratings of pH 4.1 and below, the fibrils swell to as much as 100 times their dry volume, making thick, difficult-to-stir dispersions.

However, at neutral pH's, the fibrils tangle instead of swelling, and the dispersions are unsatisfactory. Heating untangles the fibrils, making the dispersions homogenous and fairly viscous.

Heating lowers the viscosity of the other dispersions, however, making the alkaline ones watery.

On standing, most of the dispersions gel, but a gel's strength is not necessarily related to viscosity in its fluid state. Gels that are twice as strong as ordinary gelatin and insoluble in boiling water, for example, result from cooling hot acid and neutral dispersions.

The alkaline dispersions make gels that are somewhat less firm than ordinary gelatin; if made with heat, they do not gel on cooling at all.

By controlling the viscosity with heat, ARS scientists hope to make dispersions with up to 30-percent collagen that should have even more utility than these dilute ones. Work continues to explore the practicality of preparing collagen dispersions on a commercial scale and to find additional applications where the unusual properties of these dispersions can best be utilized. □

for INDIAN MEAL MOTHS... birth control slows population clock

A NEW, environmental method of birth control forces Indian meal moths, pests of stored grain, into near-zero population growth by greatly reducing egg production and hatchability. The method—rearing male moths under continuous light, and briefly exposing females to carbon dioxide.

The fertility of female Indian meal moths depends primarily on transfer of sufficient sperm by males during mating and is measured in terms of a full production of eggs during their lifetime. ARS entomologist Patrick T. M. Lum and technician Beverly R. Flaherty, Savannah, Ga., showed that females mated to males reared under continuous light laid fewer eggs (AGR. RES. April 1968, p. 8) as did females anesthetized by carbon dioxide (CO_2).

Tests by Dr. Lum and ARS technician Renie H. Phillips now show that integrating the two stresses, CO_2 and light, reduces normal female egg production and hatchability by 93 percent.

Dr. Lum and Mrs. Phillips reared the larvae at 86° F. and 60 percent relative humidity under either continuous light (LL) or alternating 12-hour light-dark (LD) cycles. At emergence, moths were separated by sex and placed in two groups: LD females paired with LD males; and LD females paired with LL males.

The researchers anesthetized some of the mated females from each group for 1 hour with commercially prepared 96-percent CO_2 gas. The CO_2 rendered the insects unconscious but was not lethal.

Mating females to LL males reduced normal egg production 65 percent; exposing females to CO_2 after mating to LD males reduced production 63 percent. Exposing females to CO_2 after mating them with LL males reduced egg production 84 percent. Even a small number of viable eggs pose a threat of reinfestation, but only 6.6 percent of these eggs hatched, compared with the normal hatchability rate of 93.5 percent.

It appears that CO_2 either inhibits egg development, renders the female incapable of laying, or else blocks the stimulus to lay eggs even when sufficient eggs are present in the female. Spermatozoa in the female apparently stimulate oviposition, and the CO_2 anesthesia may temporarily immobilize the sperm. Meanwhile, continuous light affects the male insects in some way which causes the females that mate only with them to lay fewer eggs.

Indian meal moth larvae can inflict heavy damage to stored grains, cereal products, dried fruit, nuts, and a wide variety of other foodstuffs each year. By combining continuous light with CO_2 gas, and utilizing this combination on a commercial scale, Dr. Lum and his coworkers hope to provide an ecologically acceptable method of controlling this insect pest. □

Testing precoolers for sweet corn

CIRCULATING dry, cold air through thoroughly wetted sweet corn not only produces cooling rates comparable to those now commercially obtained, but also offers potential conservation and economic advantages.

Consumers demand sweetness, tenderness, and succulence in their sweet corn. These qualities depend upon postharvest temperatures of corn, making precooling one of the most important postharvest conditioning treatments.

Hydrocooling, by far the most popular precooling method, requires large quantities of water and has great potential for the rapid spread of decay-producing micro-organisms. Air and vacuum precooling, two other popular commercial methods, are time-consuming and expensive.

ARS agricultural engineer Arthur H. Bennett and engineering technician James H. Adams, Athens, Ga., are evaluating the effectiveness of a precooling method that offers the speed of hydrocooling and the cleanliness of air precooling. This method not only uses much less water than hydrocooling, but recycles the water. It does not dry the corn or cost as much as vacuum cooling.

The ARS precooler utilizes principles of simultaneous mass heat transfer at air-to-surface interfaces by passing air through wetted corn packed in a wirebound crate. The test unit is designed to provide a wide range of airflow rates at various saturation and dry bulb temperatures. Saturation temperature for a given mass of air is that temperature at which the air can neither absorb nor precipitate any more water vapor. The temperature of the air without consideration of humidity is the dry bulb temperature. Wet bulb temperature includes the effects of humidity which can cause lower temperature readings.

Crates of corn are heated to 80° F. and thoroughly wetted before being placed into the precooling unit. Space between test walls and the crate are sealed to force maximum contact of air with each ear surface.

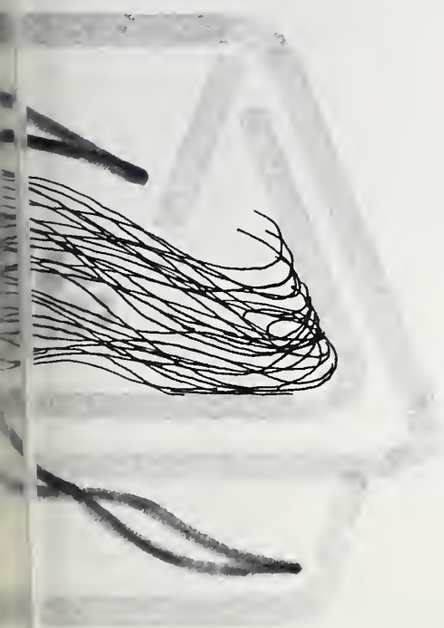
Air leaves a cooling coil at a saturation temperature with a corresponding moisture content, then passes through a fan and over heaters where the dry bulb temperature is raised to a desired level while moisture content remains constant. Since the original equilibrium point (wet bulb, dry bulb, and dew point or saturation temperature) has been altered with no corresponding change in moisture content, the air can now absorb more water vapor. To prevent frosting of corn surfaces, wet bulb

temperature is maintained at 32° F.

As the air passes through the air space around the wetted corn, it absorbs heat through convection and through evaporation of water off the corn's surface. The air is then returned through the coil where it is recooled and dehumidified to the original saturation temperature and moisture content.

Mass rates of airflow tested were 900, 1,800, 2,000 and 2,700 pounds per hour, each at initial air dry bulb temperatures of 35.0, 37.5, 40.0 and 42.5° F., respectively. Cooling rates are affected by airflow but not by dry bulb temperature.

The operation is relatively quick and thorough. No drying effect has been noticed at the end of each run. The weight of a test crate is always greater after each test run than it was initially, and the corn always has a fresh appearance. In some instances, air dry bulb temperature is lower upon leaving the corn than when entering, indicating that most of the evaporative cooling effect produced by water vapor transfer is cooling the air rather than the corn. Subsequent tests, in collaboration with industrial engineer Fred E. Henry, Gainesville, Fla., show that comparable cooling rates are achieved by using saturated air (air that has not been dried) at corresponding dry bulb temperatures and mass rates of airflow. □



COLOR MARKS THE MOTH

A rapid automatic method of code-marking cabbage looper moth for release and recovery has been developed and tested successfully.

Up to 1,500 moths can be individually spray-marked per hour using one to four permanent colors in various combinations. The method is four times as fast as the costly, tedious hand methods now in use.

Some studies of cabbage looper behavior and populations in the field involve the release and recovery of marked moths. Moths disperse rapidly and laboratory data obtained from a flight mill indicates that they can fly as far as 50 miles a day. Thus, large numbers must be released for significant recovery. The studies are part of a continuing ARS project to develop safer and more effective pest control methods. Scientists release sexually sterile male looper moths so there is no threat to cabbage or other crops.

Agricultural engineer Wayne W. Wolf and entomologist Michael W. Stimman, both of ARS and based in Riverside, Calif., modified a cyclone transfer machine to apply the colors, which are petroleum-based inks. The two scientists had developed this machine earlier to move insects speedily from one container to another without injury. It picks up the moths with a suction hose, decelerates them in a cyclone chamber, and deposits them in another container.

In the modified machine, inks are applied in short bursts from a spray gun as the moths leave the cyclone transfer machine through a discharge hose. The moths are carried in an air stream which takes them past a photocell that simultaneously triggers a counter and a time delay mechanism. This mechanism holds the air valve for an ink sprayer open long enough to get a uniform spray pattern and droplet size. The spray nozzle is far enough away from the photocell to allow the moths to pass through the predetermined spray pattern and into the cage, from which they are subsequently released in the field. □

Sugar beets line up for injections

Pressure gun replaces insect in plant inoculation

A NEW METHOD of artificially transmitting curly top virus to sugar beets when testing plants for disease resistance shows great promise.

The artificial inoculations are accomplished by means of a small pressure injector instrument commonly used in human mass immunization programs. It is believed to be the first time this instrument has been used on plants.

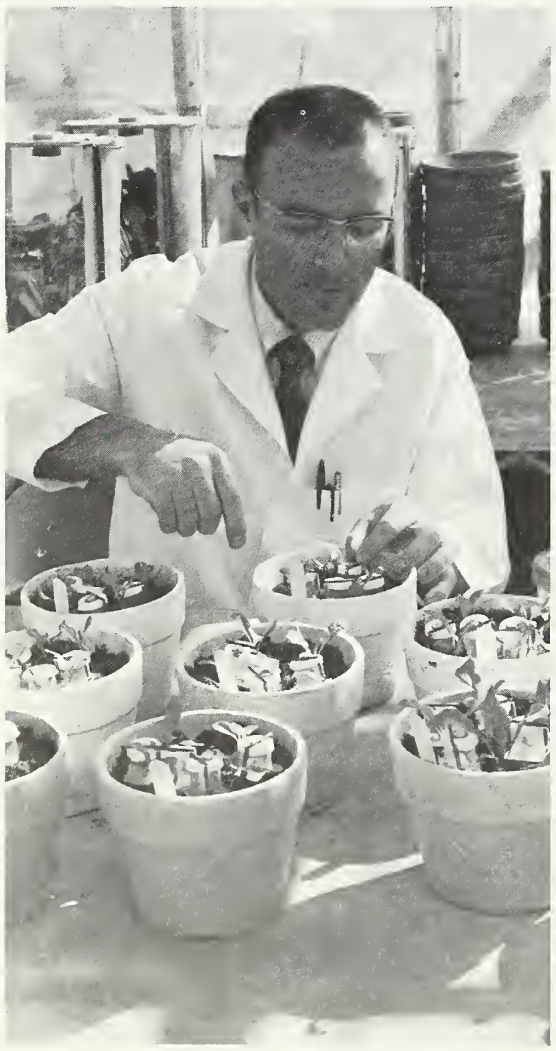
ARS plant pathologist David L. Mumford, Logan, Utah, adapted the medical technique to sugar beets to circumvent the usual time-consuming and inefficient method of natural transmission of the disease by leafhoppers.

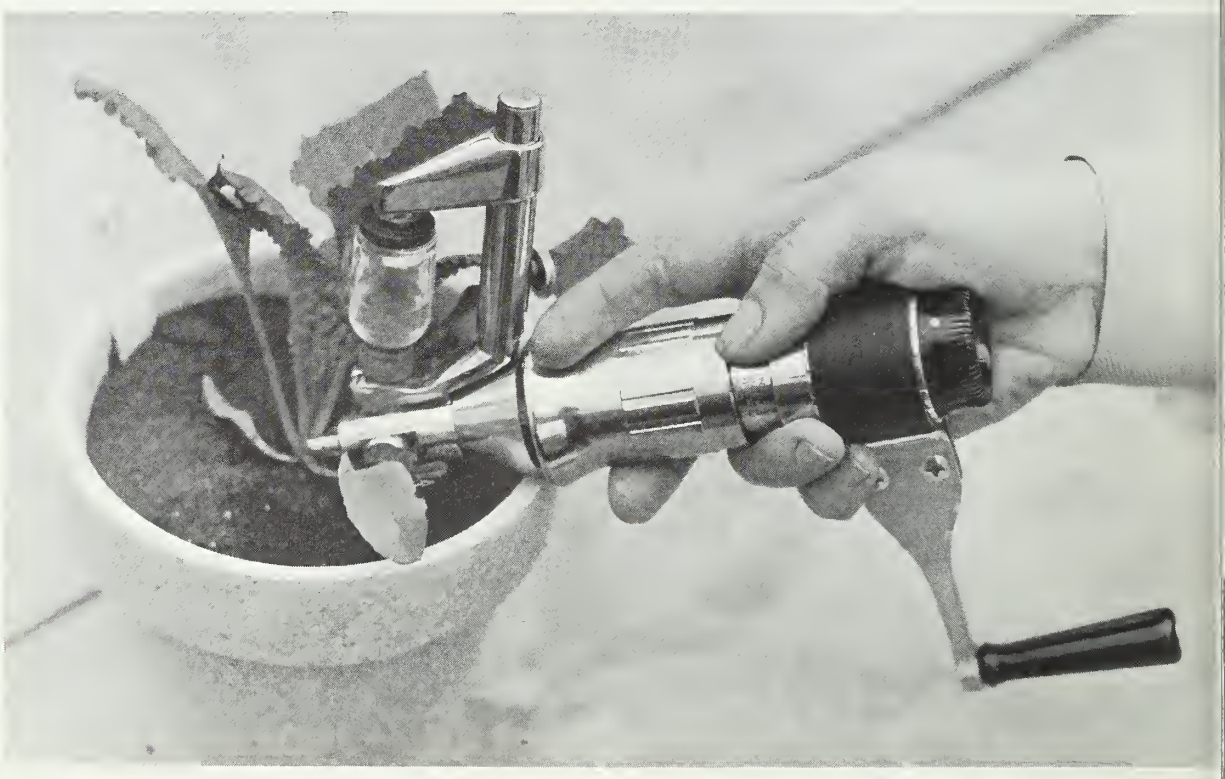
Dr. Mumford's first trials on 48-day-old sugar beets using unpurified virus have been 50 percent effective. He will attempt to purify the virus and continue the studies using varying concentrations until the method insures 90 to 100 percent infection. This percentage must be attained for effective use in a disease-resistance breeding program.

The method used today for testing curly top resistance requires that infected leafhoppers be raised and maintained throughout the beet breeding program. When plants are ready for testing, leafhoppers carrying the virus must be caged on each plant and kept there for a time sufficient to insure transmission of the disease—obviously a time-consuming, cumbersome operation requiring a considerable amount of space. This method requires 2 to 3 hours to inoculate 100 plants, while the new injector method insures inoculation of 100 plants in half an hour.

If this injection method proves successful, it might be adapted to other breeding programs to incorporate resistance to such diseases as beet yellows, beet western yellows, peach yellows, aster yellows, potato leaf roll, and others.

Although curly top is not the menace it was 30 to 40 years ago when it almost halted production of sugar beets in the western half of this country, it still ranks as the number one sugar beet disease west of the Rockies. □





Left: *Demonstrating the conventional method, Dr. Mumford uses an aspirator tube to transfer leafhoppers carrying the virus into leaf cages to inoculate individual plants. Two leafhoppers are routinely put into each cage (BN–39081).* ***Above:*** *The injector instrument in position for inoculating. The nozzle is held in the crown of the plant at a 45-degree angle for ideal penetration (PN–2019).*

AGRISEARCH NOTES

Drier air deadly to insects

Low humidity improves the effectiveness of modified atmospheres for controlling insects in stored grains.

ARS entomologists Edward G. Jay and Richard T. Arbogast and technician Gordon C. Pearman, Savannah, Ga., tested the effects of various relative humidities on red flour beetles and confused flour beetles in modified atmospheres. They found that a 33-percent relative humidity in combination with a 10-percent atmosphere killed all insects exposed for 72 hours.

Perhaps the major survival problem confronting an insect is transpiration, the loss of water in the form of vapor passing through respiratory membranes in its body. Water loss is minimized by opening or closing body vents, called spiracles, which are usually kept open just enough to satisfy the insect's oxygen requirements.

The frequency of spiracle opening and closing is influenced by the concentration of carbon dioxide and oxygen in the insect's environment. Higher than normal carbon dioxide concentrations and below normal oxygen concentrations promote the opening of an insect's spiracles. Transpiration occurs much faster in a dry atmosphere than in a humid one.

By exposing insects to combinations of the two desiccating factors, Dr. Jay and Dr. Arbogast showed that they could increase the desiccating action of low humidity, probably by producing prolonged spiracle opening that permitted rapid water loss. The result is a higher insect mortality in a given exposure time than either factor alone will produce.

Saving the graceful mimosa

Mimosa wilt, a fatal disease of mimosa trees, or silktrees, may soon stop plaguing cities in the East and Southeast with the development of new wilt-resistant varieties.

The graceful mimosa, *Albizia julibrissin,* with its fernlike foliage and mass of red to white tasselled flowers has been widely grown from New York to Florida and across the South and Southwest since its introduction into this country in about 1745.

Its characteristics of fast growth in reaching heights of 20 to 25 feet and its spreading branches for shade have made it desirable and popular as an ornamental shade tree. The past 20 years, however, have seen entire mimosa populations in a number of cities wiped out by the wilt fungus with a cost of many thousands of dollars as well as a loss of shade and beauty.

ARS plant pathologist Denzell L. Gill, Tifton, Ga., has been studying the destructive disease, which is caused by the *Fusarium* wilt fungus, in an effort to biologically control the disease through breeding resistance mimosas.

Some of the insights gained from Dr. Gill's research are that rootknot nematodes are frequently associated with increased severity of the disease, and that young trees even though harboring the fungus may not always display symptoms or succumb until 4 or 5 years have passed. Also, the *Fusarium* fungus can be carried within the seed and thus be transmitted to young plants grown from infected seed.

Dr. Gill has developed resistant selections having the same desirable characteristics of growth habit, size, and flowering. However, it will be 3 or 4 years before they will be available to the public.

Lime makes haste with pine gum waste

A simple liming technique cleans up waste water from pine gum processing plants.

During gum processing, the water used picks up a number of impurities such as resin acids, emulsified turpentine, tannins, oxalic acid, and phenolic materials. Although there has been no cause for alarm due to damage from these waters, they have traditionally been discharged into public sewage systems or natural streams and lakes.

The technique, devised by chemists N. Mason Joye, Jr., and Ray V. Lawrence at the ARS Naval Stores Laboratory, Olustee, Fla., involves the addition of 0.1 to 0.2 percent (by weight) of

lime. The lime raises the pH of the water from about 4 to 10 and causes the solids to precipitate and settle out quite rapidly, indicating that settling ponds would be effective and inexpensive. The precipitated solids can also be removed easily by filtration.

Two commercial processing plants are now using the technique successfully. The solids have not yet been examined, but they may have value if recovered and processed as a calcium resinate or as agricultural lime.

First-cross cows prove superior

The influence of hybrid vigor on reproduction was demonstrated again in tests comparing cows of European-Brahman parentage to straightbred Angus and Brangus cattle.

First-cross Angus-Brahman cows had higher pregnancy rates and fertility at first and second service, a shorter interval from calving to pregnancy, and higher milk production than either Angus or Brangus cattle.

The increased milk production contributed to faster-growing calves. First-cross cows weaned calves weighing 466 pounds, compared with 365 pounds for Angus calves and 414 pounds for Brangus calves.

These studies were conducted over a 10-year period by ARS animal scientists Walter L. Reynolds and David C. Meyerhoeffer, Jeanerette, La., and animal scientist Thomas M. DeRouen and Neal T. Poché of the Louisiana Agricultural Experiment Station, Baton Rouge.

Squeezing the best from carrots

Canned carrot juice full of flavor and color can be produced by a new process.

Carrot juice has always been difficult to can because undesirable changes occur when the juice is heated to the necessary sterilizing temperature. An unappetizing coagulum forms and settles, and the coloring material tends to precipitate out with the coagulum, resulting in an almost colorless juice.

In the new process, whole carrots are heated from 5 to 15 minutes in a very dilute food-grade acid; then they are ground and the juice extracted. Preheating in the acid bath stabilizes the juice, preventing the formation of the coagulum. The acid bath also appears to increase juice yield slightly. Chemists Thomas S. Stephens, Guadalupe Saldana, Harold E. Brown, and Francis P. Griffiths conducted the research at the U.S. Food Crops Utilization Research Laboratory, Weslaco, Texas.

When reporting research involving pesticides, this magazine does not imply that pesticide uses discussed have been registered. Registration is necessary before recommendation. Pesticides can be injurious to humans, domestic animals, desirable plants, and fish or other wildlife—if not handled or applied properly. Use all pesticides selectively and carefully.

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